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ABSTRACT

Designed to assist educators in improving computer learning opportunities for students, this packet of materials presents practical strategies that address 12 barriers to equitable instruction: (1) lack of encouragement for females and minority students to use computers; (2) potential value of computer learning more apparent to males than females; (3) bias against females and minorities in software and advertising; (4) prerequisites irrelevant for computer access and instruction; (5) limited computer access for females during free time at school; (6) underrepresentation of females and minority students in computer clubs; (7) dominance by one student over another during computer time; (8) pressure from peers not to participate in computer activities; (9) underrepresentation of females in computer leadership roles; (10) inappropriate location of computers within schools; (11) inability of teachers and students to recognize and deal with problems in computer learning; and (12) shortage of qualified personnel for computer learning. For each of the barriers, a 3- to 4-page leaflet presents illustrations and discussion of situations that constitute the barrier; suggestions for appraising whether the illustrated problem exists in a particular setting; activities for developing awareness among staff and students about the problem and its consequences; suggested actions for improving the computer learning environment; and ways to assess whether the actions have been effective. In addition, IDEAS includes a computer survey for students, an educator's self-assessment questionnaire, discussions of and suggestions for early childhood computer readiness and out-of-school computer access, and a bibliography of selected references in the areas of gender equity and computer education. (Author/JB)

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[IDEAS for Equitable Computer Learning]

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Introduction to IDEAS

Think about the following:

> Students in this fourth grade class may use the school computer only as a reward for a completed task.
>
> A 7th grade female stopped attending computer classes after school because her friends called her a "computer nerd."
>
> A small group of boys and girls in the 4th grade were playing a numbers game. The girls were very careful to type only answers they thought were correct, but the boys hit the keyboard until the correct answer appeared on the screen.
>
> A minority student in the 8th grade enjoys programming class very much, but he may withdraw from the class. There isn't enough time to complete his assignments and he does not have a home computer.
>
> The teachers in an elementary school were asked to register their classes for 1/2 hour per week in the computer lab, but one teacher refused to enroll her students because she did not want to become involved with the computers.
>
> A shy youngster, teamed with a confident student, has few chances to touch the keyboard because the teammate monopolizes the terminal.

Situations like these occur daily in schools where computers are being introduced or where they have become an existing educational resource. The message these situations convey is that some students are missing opportunities to learn about this technology. The lost opportunities are more obvious in some situations than others. For example, some students are teased by their peers because they express an interest in technology. Unfortunately, more girls than boys seem to suffer this pressure. Other lost opportunities stem from less obvious situations. A district that mandates programming as the focus for all of its computer instruction sometimes dampens students' initial enthusiasm for computers. Students who are turned off by their first exposure to computers may be reluctant to try again later or may lag behind peers.

Most educators do not intentionally discriminate among students, but they often do so unintentionally. The consequence is that some students miss the chance to learn how technology can be useful, and what role, if any, the computer can play in their lives. When asked about the participation of

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females and minority students in computer classes, especially when involvement is low, teachers may respond that "anyone who chooses...may attend this class." Such answers are unsatisfactory as explanations for low enrollment in computer instruction, use of discretionary time to practice technological skills, or membership in computer clubs. Limited participation in computer activities is a complex phenomenon that can be improved to encourage greater student exposure to technology.

IDEAS strives to help classroom educators improve computer learning opportunities for students. It informs educators about situations and behaviors that interfere with computer learning and suggests practical strategies for counteracting some of these influences. In offering strategies, it focuses on identifying existing problems, helping students and staff become aware of the problems, and suggesting actions that can facilitate equity in computer learning.

Where are the Inequities?

The microcomputer phenomenon has created a new awareness and sensitivity about educational equity. Many of the issues and the circumstances that foster them have existed for decades. Differences between genders and cultures are often emphasized more than similarities. Students learn very quickly what it means to be a male or female in our society, a Christian or Jew, a Black or an Hispanic. Certain behaviors are thought to be appropriate to these roles. As a result, people may choose careers, enroll in classes, or avoid certain activities for reasons that are unrelated to their individual talents and interests.

Inequities in computer access and use are numerous and are described in the popular press and media, in surveys and research projects, and by computer users. For example, young children are directed toward "boy" or "girl" activities. Wealthier communities tend to have more microcomputers in schools than poor communities (Quality Education Data 1982). Students who attend school in rural areas or in the South have less opportunity than those in other parts of the country to learn about computers. Ability differences tend to influence the types of learning for which computers are used--brighter students receive instruction in problem-solving and decision-making while others engage in less analytical tasks. And the lack of appealing software for females has become common knowledge.

Why is Equity Important?

Equity means fairness. The focus of IDEAS is fairness in learning about computers in school. To define inequities simply in economic, racial, cultural, or gender terms may generate awareness on an abstract level, but for educators in local school districts, such descriptions fall short of defining what needs to be done to improve the learning environment.

A translation of these broad issues to school experiences reveals situations such as the ones illustrated at the beginning of this section. The consequences in terms of learning are negative. When students "miss" a chance to

touch a keyboard, they also miss the fun of seeing an image or letter appear on the screen, feeling successful, learning what the keys represent, making the computer obey their instructions, or building upon what they have already learned. Such a loss begins a negative relationship between these students and technology. A similar destructive impact may also occur when computers are viewed as the "turf" of a particular teacher or when they are housed in a specific department such as math or business. Students whose contact with the computer teacher is limited or whose experience in math is a prerequisite to computer exposure lose learning opportunities.

It is important to recognize that inequities cross special interest boundaries, and that there are patterns of inequitable situations. If one student "takes over" when another student has difficulty executing a command, it isn't always a boy-girl problem (although boys more frequently dominate). Often a confident computer user or an aggressive youngster will behave the same way toward a passive or insecure student (male/male or female/female).

How Can IDEAS Help?

IDEAS helps educators improve computer learning opportunities for students. It is the product of a research study in which we identified situations and behaviors that impeded student computer access and use. We collected more than 300 "critical incidents" from educators and students in grades 1-9. These incidents describe situations that actually happened in schools. We classified the incidents to identify patterns of inequities, such as gender, grade, ethnicity, ability, self-confidence, and out-of-school access. These categories provided the research base for the design of instructional strategies that lead to equitable computer learning opportunities.

How are these Strategies Presented?

The format for these practical strategies emerged from conversations with educators including administrators, teachers, and curriculum coordinators. It is designed so that you can choose the activities that are best suited to a particular classroom environment. Here are the components:

- The PROBLEM STATEMENT describes the situations that constitute barriers to equity.
- ILLUSTRATIONS describe actual situations that happened to youngsters. They represent several perspectives that contribute to each general problem and show the range of the problem.
- APPRAISAL offers some suggestions for determining whether or not the problem illustrated occurs in a particular classroom.
- AWARENESS activities suggest ways to inform students and staff about the problem and its consequences prior to implementing changes.

- ACTIONS offer ideas for interventions designed to improve the computer learning environment.

- ASSESSMENT suggests ways to determine whether or not the actions have improved the situation.

We have not specified activities by grade level. We believe that most of these ideas are useful for elementary through junior high school, introductory and advanced computer courses. Teachers will almost certainly want to individualize the suggestions used to more closely meet specific intructional requirements for a school or class. Some of these problems are less likely to occur in K-3 classes, so we include a separate section for teachers of those grades.

In addition to the practical strategies offered, IDEAS includes the following resources:

- A COMPUTER SURVEY for students is provided to help you implement the proposed strategies. Using all of the questions or selected ones, you can gain information about your students and you can identify problems that lend themselves to the solutions proposed. Later, you can adapt and use the same questions to assess the effectiveness of any actions you take to improve equity. The survey questions are geared primarily to students from grade 5 and up. You can, of course, select and reword appropriate questions to use with younger children in a teacher-led activity or discussion.

- A SELF-ASSESSMENT checklist of behaviors can be used to determine whether educators are demonstrating fair and equitable practices in the classroom.

- EARLY CHILDHOOD COMPUTER READINESS is directed to teachers of grades K-3 who set the stage in school for fair attitudes and effective instructional habits. This resource offers specific ideas to help teachers create environments that encourage young children--girls and boys alike--to realize their full potential.

- OUT-OF-SCHOOL COMPUTER ACCESS: AN EQUITY ISSUE discusses the implications of some students' access to computers outside the school, particularly in the home. This resource offers practical ways for schools to foster equity in students' non-school computer experience.

- A BIBLIOGRAPHY provides a list of recent references on the topics of gender equity, computer education, and the acceptance and use of computers by girls and women.

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Student Survey

Name _____ Grade _____

Check the appropriate responses and write in answers where requested.

Background Information

1. Have you taken a computer course before? ____ Yes ____ No

   If yes, what kind of course was it? _____
   (examples: introduction, programming, etc.)

   How long did it last? _____
   (number of weeks or months, number of classes/week)

   Where did you take the course? _____

2. If you have not taken a computer course before, why not? (Check all that apply.)

   ____ None was offered.
   ____ I haven't had the time.
   ____ I haven't had the interest.
   ____ None of my friends were taking computer classes.
   ____ I couldn't meet the requirements for the course.
   Explain: _____

   ____ Other reason: _____

3. If you are taking a computer class now, why did you decide to take it? (Check all that apply.)

   ____ I like computers and want to know more about them.
   ____ My mother wanted me to take it.
   ____ My father wanted me to take it.
   ____ My teacher or counselor wanted me to take it.
   ____ My friends were signing up for it so I did too.
   ____ I think I need to know about computers for a future job.
   ____ I need knowledge of computers to become a _____, and that's what I want to be.
   ____ It is a requirement.
   ____ Other reason: _____

4. If you are currently taking a computer class, did you have to complete any courses or satisfy any other requirements before taking this class?

   ____ No
   ____ Yes Which one(s)? _____
   Do you think these requirements should or should not be made, and why? _____

   _____

5. How do you want to use computers? (Check all that apply.)

To:

____ play computer games
____ design computer games
____ write stories, letters, and papers
____ do graphics or drawing
____ write programs
____ other: _____
(Describe any other goals you have.)

6. How would you describe your computer experience? (Check all that apply.)

____ I have no previous experience with computers.
____ I know how to load diskettes into a computer.
____ I know how to use the keyboard.
____ I know how to use a menu on the computer.
____ I have played video games on a computer.
____ I have played educational games on a computer.
____ I have used word processing to write stories, letters, or school papers.
____ I have used graphics applications to draw pictures or graphs.
____ I have written some simple computer programs.
What does your best program do? _____
____ Other experience: _____

7. Do you have a computer at home? ____ Yes ____ No

If yes, what kind is it? _____

How do you use it? (Check all that apply.)

____ for school assignments
____ to play games
____ to program
____ other: _____

____ I don't use the computer at home because I:

____ don't like to use it.
____ don't know how to use it.
____ don't have time to use it.
____ am not allowed to use it.
____ other: _____

Who else uses the computer at home? ____ mother ____ sister
____ father ____ brother
____ other: _____

8. Do you use any other computers besides one at home or at school? ___Yes ___No

If yes, where is it? _____

Computers at School

9. When are computers available for you to use at school during free time? (Check all that apply)

___ before school
___ after school
___ during lunch
___ during free period
___ other: _____
___ not available
___ don't know

10. When do you presently use the computers, or when would you use them if they were available? (Check all that apply.)

	I already use computers:	I would use computers:
before school	___	___
after school	___	___
during lunch	___	___
during free period	___	___
other: _____	___	___

___ I do not (or would not) use computers during free time because _____
_____

11. Under what conditions would (do) you use or not use computers during free time? (Check all that apply.)

	Would use	Would not use
by myself	___	___
with friends	___	___
with separate times for boys and girls	___	___
by sign-up ahead of time	___	___
other: _____	___	___

12. Have you ever been unable to use a computer because of its location in the school?

___ No
___ Yes Explain: _____

13. Because we have more students than computers at school, you sometimes have to share a computer with a partner or small group. What do you like Most and Least about working on the computer in each of these ways?

	Most	Least
by myself	_____	_____
	_____	_____
with a partner	_____	_____
	_____	_____
with a small group	_____	_____
	_____	_____

14. When you have a question or problem on the computer that you can't solve, what do you usually do? (Check all that apply.)

____ ask the teacher
____ ask a friend
____ ask another student who knows the subject well
____ wait for someone to notice that you need help
____ skip the problem and work on something else
____ other: _____

15. How do you feel about helping other students to learn about computers?

____ I would like to help other students during class time.
____ I would like to help other students during my free time.
____ I would not like to help.
____ I am not qualified to help.

16. How do you feel when a person of the other sex helps you with problems in class?

____ I am glad to get the help.
____ I am a little embarrassed, but I appreciate the help.
____ I try to get help from the teacher instead.
____ I prefer to work alone.
____ other: _____

17. Are you a member of the school computer club?

____ Yes ____ No ____ There is no computer club.

Complete these statements. Circle the words in parentheses that apply to you.

I (joined, have not joined) the computer club because _____

_____

I (like, do not like) the computer club because _____

_____

I wish the computer club would _____

_____

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Educator's Self-Assessment

The following questions are divided into sections that correspond to the IDEAS for equitable computer learning. To answer the questions in each section, mark a √ on the line if your answer is Yes. Leave the line blank if your answer is No. If you have one or more blanks in a section, refer to the strategies for overcoming that barrier.

Barrier: Lack of encouragement for females and minority students to use computers

Do you

___ 1. have counselors or teachers in your school who encourage girls or minority students to enroll in computer classes and pursue careers in computer-related fields?

___ 2. include bulletin board displays that would enable any student in your class to identify with a computer user shown and say "I could do that" or "I could be that"?

___ 3. encourage parents to let their daughters and sons enroll in computer classes, attend computer camps, and use a computer at home?

___ 4. incorporate strategies to raise your students' awareness that career possibilities in computer-related fields are based upon competence, not gender?

___ 5. provide positive role models of computer users for females and minority students with parent visits, other guest speakers, or field trips?

___ 6. avoid making remarks that suggest that girls generally like certain types of computer activities and boys another?

___ 7. praise both girls and boys for their computing achievements: correct responses, products, willingness to try, perseverance?

___ 8. have the same expectations--explicit and implicit--for girls and boys in your classes (in attaining programming skills or maintaining an orderly work station)?

___ 9. refer to your students as a group in terms of their commonalities ("students," "class," "computer wizards") rather than their differences ("boys and girls")?

___ 10. encourage girls to experiment and try new approaches and activities on the computer?

___ 11. use non-biased language, particularly relating to computers (computer user, business person, sales representative/sales rep)?

Barrier: Potential value of computer learning more apparent to males than females

Do you

___ 12. define specific instructional goals for each computer assignment?

___ 13. explain to students the practical value of each computer activity ("This activity will help you learn to . . ."?

___ 14. provide computer activities that clearly apply to your students' everyday lives or their futures (keeping track of student sales for a school fund-raiser or using the computer to do tasks for other classes)?

___ 15. point out computer-related or computer-generated materials that appear in your classroom (prints-outs of class rosters, grade reports, codes on library books)?

Barrier: Bias against females and minorities in software and advertising

Do you

___ 16. have a school or district procedure for evaluating software for bias in gender and ethnicity?

___ 17. provide an adequate quantity and variety of non-sexist software?

___ 18. report to the person who purchases software for your school (or to the publisher) any software you find violent or biased and the reasons for your objections?

___ 19. incorporate consciousness-raising strategies to point out the bias in many advertisements and software packages?

___ 20. supplement inadequate or incomplete treatment of either sex in software and other classroom materials by adding information or discussing the inaccuracies of the portrayal?

___ 21. exclude software that involves the shoot-'em-up or blow-'em-up activities found in many arcade games?

Barrier: Prerequisites irrelevant for computer access and instruction

Do you

___ 22. limit the prerequisites for computer classes to courses or skills that are directly linked to computer instruction, avoiding those that exclude some students and are not directly linked, such as math?

___ 23. make computer activities an integral part of instruction and not just rewards for completing other work or meeting a certain standard like reading at grade level?

___ 24. have school policies that tend to encourage girls, minority students, and/or low-income students to take computer classes?

Barrier: Limited computer access for females during free time at school

Do you

___ 25. establish sign-ups to ensure that free time on computers is equitably distributed so that no student or group "takes over" regularly?

___ 26. make the computers, the computer club, and computer activities available to all students equally outside regular classroom time?

Barrier: Underrepresentation of females in computer leadership roles

Do you

___ 27. choose both girls and boys to set up or operate equipment in the classroom (establish computer networks, boot the system)?

___ 28. have a representative number of girls serving as computer tutors, assistants, and leaders in computer activities or classes?

___ 29. assign girls to take leadership positions in computer activities?

Barrier: Dominance by one student over another during computer time

Do you

___ 30. assign students to pairs or groups in accordance with instructional goals, not by sex, friendship, or accident?

___ 31. structure computer assignments so that each student in a pair or group shares the task equally?

___ 32. monitor students working together at computers to ensure that each team member takes a turn at the keyboard?

___ 33. recognize and praise good teamwork among groups of students at computers?

Barrier: Pressure from peers not to participate in computer activities

Do you

___ 34. believe that most students in your school can display computer expertise or interest without being ridiculed or "put down"?

___ 35. intervene when you observe students calling someone a "computer nerd" or otherwise ridiculing a student who has enthusiasm and expertise about computers?

___ 36. note that students seem able to resolve any conflicts between computer activities, like computer club or after-school computer time, and sports or social activities?

Barrier: Underrepresentation of females and minority students in computer clubs

Do you

___ 37. recruit females and minority students for membership in the computer club?

___ 38. plan computer club activities that appeal to a wide range of students?

___ 39 encourage girls and boys to take a variety of roles in extracurricular activities (secretary of the computer club, head of the food committee, treasurer, president)?

Barrier: Inappropriate location of computers within schools

Do you

___ 40. have computers placed so that they are accessible to students throughout the day?

___ 41. have computers on carts so that they can be moved easily?

___ 42. assign computers to departments or teachers so that a maximum number of students can be exposed to the technology?

Barrier: Inability of teachers and students to recognize and deal with problems in computer learning

Do you

___ 43. incorporate regular, formalized support strategies in which students can ask for--and receive--help when needed?

___ 44. encourage students to use problem-solving skills for computer-related problems rather than just give them the answers?

___ 45. train your assistants, aides, and tutors to circulate around the classroom to help as needed?

___ 46. train your assistants, aides, and tutors to help a student to solve a problem rather than do the work themselves?

Barrier: Shortage of qualified personnel for computer learning

Do you

___ 47 utilize aides, parents, or students as assistants to help students with their computer work?

___ 48. have adequate supervision and assistance for students so that computers can be used throughout the school day and before and after school?

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Early Childhood Computer Readiness

By the time girls reach the upper primary and junior high school grades, many are averse, perhaps even phobic, to mathematics, science, and computers. This aversion is rooted in social attitudes about gender roles and sex-linked aptitudes. These attitudes reflect stereotypic beliefs about the differential abilities and interests of boys and girls--beliefs that are instilled in children, often unintentionally, from a very early age. These beliefs often become self-fulfilling in terms of what girls and boys ultimately can and want to do. At least two types of gender bias permeate educational and social settings during early childhood:

1. The belief that some activities are suitable only for boys and others suitable only for girls. Examples from childhood through adulthood are numerous. Little girls play with dolls, little boys play with cars; older girls become cheerleaders, older boys join the team; women clean the house, men fix the plumbing.

2. The belief that certain aptitudes and personality traits are sex-linked--for example, the notion that boys are naturally strong and athletic while girls are gentle and helpful; that males are naturally mathematical and scientific, while females are verbal and intuitive.

Perceptions about such differences strongly influence how we expect children to perform and how children view their future. These perceptions contribute to the bias apparent in young children's learning experiences. Early childhood educators should be aware of these biases so they can work to minimize their effects and create equitable learning environments.

While the problems and strategies presented in IDEAS may have more practical use in upper primary and junior high school settings, some of the suggestions may be useful for K-3 class activities, especially in schools where a computer curriculum is in place. By applying many of the underlying concepts, schools can set the stage for every child's future. They can provide experiences in grades K-3 that encourage children to develop attitudes, abilities, and interests that are free from gender bias. The following paragraphs offer some practical ideas teachers can adapt to foster more equitable learning patterns and behaviors in young children. The ideas fall into three categories: 1) suggestions designed to counter sex-linked beliefs about activities and aptitudes, 2) activities to enhance math-science readiness skills in the early grades, and 3) activities to introduce all students to basic computer concepts and to encourage interest in computers in a stimulating and non-threatening way.

Activities to Counter Gender Bias and Stereotyped Beliefs

1. De-emphasize differences and emphasize qualities shared by all children in the following ways:

- Set up learning centers that encourage both girls and boys to participate in activities and assume roles they might not ordinarily choose--for example, housekeeping, cooking, blocks, carpentry, and art.

- Assign and rotate class jobs and roles among students without regard to gender. Girls can carry the sports equipment and boys can pass out the snacks.

- Group and line up children in new ways to stress their commonality and to encourage boys and girls to be together. Try grouping alphabetically or by birthdays or hair color, not by gender. Do not create "girls against the boys" situations.

- Use language that is free of gender bias to encourage children to have a less stereotyped view of the world. Refer to your class as "children" or "students" rather than "boys and girls." Use gender-free job titles such as police officer, firefighter, and sales clerk.

2. Encourage high performance from all students, regardless of gender.

   - Make it clear that you expect both girls and boys to participate in all class activities and that you believe they are able to do so.

   - Discuss with students what they think girls and boys can and cannot do. Do these capabilities apply to them? Why or why not? For example, girls may see themselves as less fit then boys to play sports or run science experiments. Discuss the importance of experience and practice to successful performance--not whether someone is a boy or girl.

   - Provide girls the opportunity to excel in arithmetic and science. Plan activities and present problems that interest girls as well as boys. Be sure to call on girls to participate in discussions and experiments. Encourage their involvement in science clubs and science fairs. Allow girls to assume leadership roles. Do not succumb to the stereotypic belief that girls are passive, uninterested learners of math and science.

3. Encourage young children to expand their perceptions of what they can do in the future. Build their awareness of new options in the work force for both men and women. Try out these ideas:

   - Have students role-play different jobs. Be sure to have girls and boys assume non-traditional roles: have girls play astronaut, computer technician, dentist; have boys play nurse, teacher, word processor.

   - Create bulletin boards that depict both men and women in math, science, and computer jobs.

- Organize field trips, invite guest speakers, and share books and film strips to demonstrate the many options available in the world of work for boys and girls alike.

- Initiate class discussions about jobs and who should do them, encouraging the belief that virtually all jobs can be done by anyone who has the interest and motivation to do them.

Math-Science Readiness Activities

Although their relationship has not been firmly established, computer skills are commonly linked to math/science skills and are likely to remain so. Therefore, enhancing students' math and science readiness in the early grades may foster their computing readiness as well. Early readiness activities are likely also to stimulate among girls a greater interest in math, science, and computers than they ordinarily might develop. The following ideas may be helpful:

1. Provide all students extensive opportunities to participate in active sports and to play with blocks and other construction toys, cars and other push-pull toys, models, puzzles, tools, sand and water, chemistry sets and microscopes. Research suggests that these experiences are important in the development of spatial, mechanical, and problem-solving skills that are closely related to successful performance in math and science. These experiences are typically enjoyed by boys in the early grades. Through increased manipulative play, girls as well as boys can acquire the skills needed to do well in math, science, and computer learning.

2. Carefully assess the math-science readiness of children in your class. To make up for any identified deficiencies, provide "compensatory" learning experiences as needed to bring them up to the appropriate level.

3. Help children develop positive attitudes about learning and "failure." Encourage them to see that solving a problem incorrectly the first time is not a "failure," but rather an opportunity to try other solutions. Emphasize that "failures" may be rooted in lack of experience or information rather than in native ability. At the same time, facilitate successful experiences, particularly in math. Make math less threatening to students by decreasing emphasis on speed and testing. Make it more fun and relevant by using games, puzzles, calculators, and team problem-solving.

Computer Readiness Activities

In addition to the math/science strategies outlined above, teachers can develop some computer readiness skills among students. You do not even need a computer in your classroom to try out these ideas:

1. Train girls, as well as boys, to use classroom machines--projector, TV, VCR, computer. Encouraging all students to help with the equipment will put them at ease with machines in general.

2. Teach students how to use a keyboard--important preparation for using a computer. Using a computer terminal with a typing software package is ideal. However, a standard typewriter or a paper keyboard will also suffice.

3. Teach basic concepts of programming through simple activities. Using and programming a computer involve language manipulation. The computer "knows" only a few special words. To program the machine, you have to use the computer's own vocabulary. To demonstrate this concept to young children, try the following pre-programming activities:

   - Describe how every action is made up of smaller actions. Give students a list of movements (right foot forward, left foot forward, lift arm, close fingers, etc.) and have them try to list instructions for opening a door, walking across a room, and turning on a light. Have them test their list by following the instructions themselves.

   - Ask students to write a list of instructions in a limited vocabulary and have someone follow the instructions exactly. If you have access to Big Trac, turtle graphics, or Papert's robot, use them. If not, you be the "robot" that traces out a square or rectangle, or walks across the room avoiding desks.

   - Organize a treasure hunt. One team member knows where a treasure is in the room or on a map and must give the other members detailed instructions on where to find it.

4. Demonstrate another aspect of computing called "modularization." Little instructions are combined, given a name, and then become instructions themselves. You can illustrate this with a variant on Simon Says. You can give names to unusual combinations of basic steps, and then call them along with other steps. For example, 2 giant steps forward and a baby step to the right = "galumph"; a scissor step and a complete spin around = "tweedledee." Simon can then instruct the children to take two galumphs and a tweedledee.

The suggestions offered above represent varied approaches that early childhood educators can use to create the equitable learning environment that all of our children deserve. Working to discourage stereotyped gender-biased attitudes and encouraging all children to develop math, science, and computer readiness will go a long way toward creating such an environment, and will foster young children's potential.

References: For more information about non-biased learning activities, see the following:

Shapiro, J., Kramer, S., and Hunerberg, C. (1981). Equal their chances. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Crites, A., Stritzel, K., and Wortman, R. (1982). First focus: Equity.

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Out-of-School Computer Access: An Equity Issue

In planning school computer programs, educators need to consider students' opportunities to use computers out of school. Students' access to computers at home or some other location away from school is an equity issue: the absence of additional computer access for some students leads to disparities in learning at school.

Out-of-school access to computers may influence a student's approach toward and use of computers. For example, students who use computers at home have time to practice and to experience trial and error. They become comfortable with the machines and the technology. Often a parent, sibling, or friend is available to help young users, further reducing their anxiety toward computers. Students may reinforce their computer knowledge by explaining to someone at home what they did and how they did it. Many students utilize word processing to prepare homework, or use other applications to practice academic skills. Although the educational value of home computers depends on how they are used, their availability is the necessary first step.

Few low-income students have home computers, and females who have access to computers in their homes tend to use them less than male family members.

> Terri liked doing multiplication drills on a computer in her eighth grade remedial math class. She said using the computer in this way was fun, but she didn't seem to be interested in spending additional time working with computers. Her parents have just bought her two brothers their own computer. They keep it in their bedroom and play games on it. Terri has had nothing to do with the machine, and no one at home has encouraged her to explore its capabilities.

This incident illustrates three facts about home computer ownership: (1) girls tend to be less interested in using home computers than boys; (2) parents are more likely to buy home computers for their sons than for their daughters; and (3) females are generally given less encouragement to use home computers than males. Not only are males more interested in computers and given more encouragement to use them, but males are more likely to visit video arcades, where they play games and gain confidence in using computerized equipment.

Here are three ways schools can foster equity and quality in their students' out-of-school computing experience:

1. Educators can increase community access to school computers during hours that the computers are usually left idle. Increasing this community access may require a fair amount of ingenuity to work around administrative requirements and restrictions. The support of your own school administrators will be extremely helpful. You may also be able to work with interested parent groups in your community. You might try these strategies:

- Develop a program to lend school computers to parents during weekends and summer months. If possible, provide at least a minimal amount of preparatory instruction on use before you lend the machines.

- Open the school computer lab or classrooms to the community on weeknights and/or weekends for software review, drills, and general exploration. You can do so on a regular schedule or by appointment with special groups such as the Girl Scouts, or by some combination of the two. Training and supervision can be provided by the school district or by community volunteers enlisted, and perhaps trained, for the purpose. Publicize the availability of the computers and encourage their use by organized, responsible groups. For instance, send a memo home with your students and a press release to the school newsletter and community newspaper.

- During Back-to-School Night or parent conferences, try to enlist the support of parents who are anxious to have a strong computing program in the school. Let parents come to school to teach computers after school or on weekends. Work with parents to organize special events such as a computer workshop for parents and children and a computer resource collection in the school library. For example, parents can donate back issues of periodicals that review educational software.

2. Schools can provide quality computer experiences by developing ideas for educational activities and coordinating home and school computing experiences. You might try these ideas:

   - Develop a list of the hardware in your school (or in each school of the district) so that interested parents can coordinate their purchases with equipment available in their children's classrooms.

   - Develop a software loan program to allow parents to try out software owned by the school.

   - Invite parents to visit the school and try out the school's software. Have a software demonstration ready for Back-to-School Night. Be prepared to tell what you think is good or bad about each product, especially from an equity perspective.

   - Work with experienced teachers and media specialists in the district to develop and distribute a list of software used in the schools. Indicate the skills taught by each product. Considering both equity and educational value, develop guidelines that parents can use when purchasing software for their children. Incorporate your students' ideas about what makes software educationally sound, interesting, and challenging to use. Include a list of periodicals that review children's software. Encourage parents to provide their daughters, as well as their sons, with computers and software that appeals to them.

   - Be prepared to discuss your students' computing skills and needs with their parents. Suggest the kinds of practice that the child might profit from, such as programming in Logo, word processing, math drills, or games.

- Develop a list or a computerized clearinghouse of community organizations and businesses that offer computer training and hardware/ software previewing.

- Develop a pre-purchase information sheet to help parents decide what kind of computer to buy. Include a list of the various kinds of applications that computers are used for and how these applications can fit educational needs. For example, computers with word processing capabilities can be used to write stories (reading/ writing practice); computers with graphics can be used to develop artistic expression (colors, patterns, design); and of course computers with CAI applications can be used for drill, practice, and other instruction in a variety of subjects. Include references that would help parents make informed decisions about computer purchases.

3. Schools can try to minimize the differences that are caused by access to home computers. You might follow some of these suggestions:

   - Offer the less experienced students extra practice time on the computer, either during school hours or at some special time before or after school.

   - Reassure students who have not used a computer before. Tell them that they should expect to make a lot of mistakes and that figuring out how to fix them is a good way to learn--they should not get discouraged but just keep trying. Novices may need more encouragement than some of the more experienced computer users.

   - Investigate the possibility of pairing students who have home computers with students who do not, for home assignments. One possibility is to demonstrate the variety of microcomputers used by students' families. Have each pair of students report on some features of their home computer.

In all three of these ways--increasing community access to school computers, acting as a resource for parents, and minimizing differences in the classroom--schools can help offset the effects of unequal access to computers. Here is an illustration of how such efforts can pay off:

> Lupe and Kelly shared a computer terminal in their sixth grade classroom. Each student in the class was expected to share equally in programming activities, but because Lupe had never used a keyboard before, she had a hard time keeping up with her assignments. Kelly was frustrated because Lupe's inability to type quickly held up their team efforts. When Kelly realized what the problem was, she took Lupe home with her and taught her how to use the keyboard on her home computer. Now that she can type, Lupe is no longer afraid of working on the computer.

Reference: For more information about how parents can work with schools, see the September 1984 issue of Family Computing, "Putting Out the Welcome Mat--12 Ways to Get to Know Your School's Computer," p. 16.

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Lack of encouragement for females and minority students to use computers

Delia was a star programmer at her school and worked as a peer tutor in the computer lab during her elective period. Although her parents were pleased to see her doing so well, her mother thought it would be much nicer if Delia used her free period to take a crafts class. Her father wondered how Delia could bear to be cooped up with the computer so much. He was always glad to get away from his office computer.

Rita, a sixth grader, stated that girls "shouldn't have careers that need computers" because "that is something girls just don't do." She went on to say that guys won't like girls who work with computers. Girls participate in computer classes only because they are required to attend; the boys are the ones who are really interested in them.

When Lucy was in sixth grade last year, she wanted to take a computer class. Her parents refused permission. They said she should "stick to the basics," since they are much more relevant to her future than was computing.

Tom and Karin O'Connell have a computer at home. Their father works in the electronics industry and encourages his son to learn about computers. Tom uses the home computer extensively and plans to pursue a technical career similar to his father's. Karin, in contrast, is not interested in using the computer, and neither parent offers any encouragement for her to do so.

These examples illustrate how females and minority students can be discouraged from learning about and using computers. Attitudes about who should and should not use computers come from many sources. Certainly parents and the home environment are critical to the attitudes children develop. As shown in these examples, parents frequently discourage their daughters from pursuing computers. In addition, students, like Rita above, are locked into stereotyped beliefs about what girls should and should not do, and are sensitive to how others perceive them. The media, the peer group, and the scarcity of effective role models can also discourage females and minority students. These influences are addressed elsewhere in IDEAS. The focus here is on how to counteract the negative effects of home and family factors and of stereotyped attitudes in general.

Appraisal Determine whether girls and minority students in your school receive less encouragement to learn about computers than non-minority boys do.

Here are some ideas.

1. Review the results of your survey questions about home computers (#7) and about why students signed up for this course (#3). Compare the responses of boys, girls, and minority students. What percentage of the boys have access to and use home computers? What percentage of the girls do? Minority students? Is there evidence that the boys in your classes receive more encouragement at home in regard to computers than the girls do? What other reasons prompt students to enroll in computer classes?

2. Survey some students who have not enrolled in a computer class. Use the survey questions relating to home computers (#7) and enrollment in classes (#2). Ask additional questions about why they have not enrolled in a computer class, whether and how they think such a class could be worthwhile, and what they perceive the attitude toward learning about computers is at home and at school.

Awareness Make students, teachers, and parents more aware of how boys, girls, and minority students are encouraged and/or discouraged from learning about computers.

Here are some suggestions.

1. Discuss the results of your survey activities in class. Emphasize issues relating to parental encouragement, access to computers at home, and attitudes about male and female roles in the world of computers.

2. Prepare an article for the school newsletter in which you share the results of your survey. Point out any differences indicated between the encouragement given to boys and to girls.

3. Hold a class debate on this subject: Computer careers offer opportunities to everyone. Include boys, girls, and minority students on each team. Follow the debate with a class discussion.

Action Implement strategies to encourage girls and minority students to learn about computers.

Here are some strategies.

1. On Back-to-School Night or Open House, display students' computer assignments around the room, including an equal number of those done by girls and boys. Also, have a bulletin board depicting computers in modern life, being sure that the workers using the computers include men, women, and minority members. Examples could include a cashier using a bar code reader; a restaurateur using a table assignment program; a consultant helping users to understand their machines; a computer salesperson; a

programmer; and anyone using a bank teller machine, an auto diagnostic machine, or a database system in a hospital.

2. During Back-to-School evenings and parent conferences, urge parents to take their daughters' computer proficiency seriously. With parents who have home computers, point out that time at a home computer is as important for their daughters as for their sons and should not be regarded simply as a recreational activity. Discuss the possibility that girls' and boys' interests and tastes in software often differ. Suggest that parents talk to their daughters about how they would like to use the home computer. Mention applications that seem to attract girls--their daughter in particular--in the classroom. Suggest that learning how to use the computer may be a good activity to bring fathers and daughters together (but urge mothers to join in too). Urge parents to monitor the amount of time their children spend on their home computer. Are daughters given as much time as sons? Are children spending so much time on the computer that they are neglecting other subjects or interests?

3. At Back-to-School Night, discuss the goals of your computer curriculum. You should be able to assuage the fears of parents who think other subjects suffer when computing is added to the curriculum or that you are planning to produce a classroom full of hackers. Explain the importance of preventing technophobia in a generation of students who are already living in a high-tech world. Discuss the importance of helping students to keep their options open so that if they do decide to work with computers, they will be prepared to do so.

4. In parent conferences, discuss progress in computing skills. Make it clear that you expect as much proficiency from your girls as from your boys. Suggest that parents of girls who are enthusiastic computer users send their daughters to computer camp and encourage the girls to use the school or home computer during free time. Mention that although computer careers have traditionally been considered "male turf," some industry observers are now talking about the gifts that women bring to computing. Traditionally, women have been trained to be concerned with details, social relationships, and helping. These are all important skills for programming (writing programs that are understandable to other users), documentation, user assistance, and computer sales.

5. Investigate parents' interest in learning how to use the class microcomputer. Make it possible for parents to come to school, perhaps to "team learn" with their own children. This affords an excellent opportunity to bring women and minority members into the classroom as role models as well as to increase the number of parents who can help children at home.

6. Hold a class discussion on jobs that students want to have as adults. When students are aware of the various kinds of computer jobs, ask them if they think some of these are only for men, women, or non-minority groups. Be prepared to give examples of men, women, and minority members in all types of jobs. Discuss the fact that ideas about who should do a job change over time. For instance, at one time the jobs of clerk and nurse were held by men. At one time all astronauts were men. We may think that computing jobs are for men, but there are increasing numbers of women in such jobs.

7. Have your students play "Fears in the Hat," a game in which everyone writes down a "fear" or myth about girls or minorities and technology. Place the fears in a hat, draw them out, and hold a class discussion to debunk each myth.

8. Have students report on the biographies of historical figures. Include female scientists and mathematicians and members of minorities in the list of figures. You may need to provide the biographical materials yourself.

9. Arrange a field trip to a company that uses computers in a variety of ways. Ask that workers, including women and minority members, explain their jobs including the requisite education, experience, and skills involved.

10. Invite several women and minority members in computer occupations to class for a presentation or panel discussion about computer careers.

11. When you choose students to perform particular tasks in the class or with the computers, try to select representative numbers of males, females, and minority students to do each job.

12. Pick a female student who enjoys using the computer and ask her to talk about how she became interested in learning about the computer, what she does with the computer, and whether and how she sees the computer as part of her future. Ask minority students to give similar talks.

Assessment Determine whether females and minority students are receiving more encouragement to learn about computers.

Here are some suggestions.

1. Again, survey the students--particularly girls and minority students. Ask questions that will reveal any evidence of changed attitudes at home and at school, increased interest in and use of computers, and changed perceptions about the role computers can play in their future.

2. Check informally with some of the girls and minority students in your class to see if they have noticed changes in attitude toward their involvement with computers. Ask those with home computers if they are being encouraged to use them more.

3. During subsequent Open Houses or parent conferences, discuss with parents whether their attitudes and behaviors have changed in terms of encouraging girls and minority students to learn about and use computers. Ask parents whether they perceive changes in their daughter's attitudes and interest in computers.

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Potential value of computer learning more apparent to males than females

> Three high school girls did not intend to enroll in either of two available computer classes. They felt that the word processing course offered was uninteresting and lacking in practical skills for getting a professional job. They described the programming class as "tedious and repetitive." One of them complained, "You can spend weeks working on the same problem and still not get it to run because of a little bug. When you do get it to work, it isn't such a big deal."
>
> A fourth grade class was supposed to be working on an elementary programming activity. Instead, Denise was using the word processor to create a story that she had been working on for about a month. Almost all of the girls in the groups were clearly more interested in the story than the programming; they came over to observe and comment on Denise's work, and neglected their actual assignment.
>
> At one elementary school, computers were universally popular with second graders who perceived the computers as new and different. The activities were similar to video games with which most of the children were familiar. The students also liked computer math and spelling drills. By the sixth grade, however, they were becoming bored with CAI. The available software was not challenging enough, and the programs did not match the students' interests and capabilities.

These examples reveal students who are uninterested, even "bored" with existing computer instruction. Students experience the work as simply uninteresting or irrelevant to their needs now or in the future. The research compiled for IDEAS revealed many positive incidents wherein students were motivated by computer activities that seemed relevant to them. Other research indicates that females are more interested in using computer applications such as word processing, data management, or spread sheets than in learning programming. A study reported in The Computing Teacher (April 1984) revealed that a higher proportion of males than females was interested in programming, while females preferred non-programming applications. For both males and females, learning is enhanced when students see practical ways to use that learning. Educators should, therefore, identify the interests and needs of their students--male, female, and minorities alike--and develop computer courses and activities that reflect these needs.

Appraisal Determine the relationship between your planned computer activities and how your students see using the computer, now and in the future.

Here are some ideas.

1. Review the set of computer activities used for each class. What are these activities designed to accomplish?

2. Look at student responses to survey question #5 on how students want to use computers. Do your plans include activities that match their objectives?

3. Analyze each computer activity in terms of its practical application.

4. Share with students your plans for the class. Ask for suggestions about how they would like to use the computer. For example, you can ask, "What do you like to do with computers? write letters? play games?" (If they lack ideas, some of the strategies listed below may help them identify potential uses.)

Awareness Help students become aware of how widespread computer use already is today and how important computers are likely to be in their future.

Here are some strategies.

1. Ask your students to collect items that show the computer's role in our lives. Give some examples to get them started: a computer-printed department store bill, a toy that contains a computer, a computer-generated airline ticket, a credit card with magnetic tape on the back, a receipt for a transaction with an automatic bank teller, a computer-printed school schedule or grade card, a computer-generated grocery tape, and a "personalized" letter issued by a computer. Give students credit for each type of item they bring in, and have them tell other members of the class how the computer was used to produce the item. As your students share different items, point out the role the computer had in it and the part that people had in it (the grocery checker, the travel agent, etc.).

2. Ask your students what they think life will be like ten years from now as technology advances. How will they be involved? Try to develop awareness of the options and opportunities available. Then remind students of the wisdom and necessity of learning how to be comfortable with technology and learning how to use it to help them--as a tool. Begin with this class!

3. Have a group of students demonstrate ways that computer skills are useful in other activities. For example, students could show how designing a BASIC program helped them make logical plans for other projects. Ask the rest of the class for their comments on the demonstration topic.

4. Let your students play a game to help them see the importance of giving clear directions--to a friend or to a computer. You can let pairs of students do this activity independently while others are working at the computers and at other tasks, or you can make it a class activity.

   The game involves giving pairs of students identical sets of four or five small objects of varying shapes (a block, a piece of chalk, a small ball, a pencil, an eraser). Ask each pair to sit back to back, so neither can see what the other is doing. Have one of the two form a design with the objects and then give directions so the other student can create an identical design. When they are finished, have them compare the two designs.

   On first attempts, the designs usually differ, and the students can see the flaws in their directions. If the problems are not obvious, try to point out the critical information that was left out. Let the partners trade tasks and repeat the activity. You can give them new sets of objects--for example, a set of pencils that varies only in color or a set of balls that varies only in size and color--or let them use the original set repeatedly. Each time students do this activity, their directions should become more precise.

   As you go along, help students understand when critical information was omitted. Then discuss how computer programs can be affected when information is left out. You can have students give directions for almost any step-by-step activity and ask another student to follow the directions exactly--for example, how to tie a shoe lace, reach the school office, or make a peanut butter and jelly sandwich.

Action Develop computer activities that are more related to the interests and needs of your students now and in the future.

Here are some strategies.

1. Plan field trips to local businesses that use computer technology so that your students can see what people do with computers, what training and education the employees need, what the job environment is, and what the job satisfaction is. Try to locate non-traditional role models for different types of students.

2. Incorporate computer use into other classroom activities such as the school newspaper, recording students' achievements in school sports, keeping track of individual sales for fund-raising activities, and preparing documents for field trips (parent permission slips, instructions to students, guide of "what to look for," etc.).

3. Work with other teachers and volunteers to design computer activities that demonstrate immediate and long-term relevance. Have each person critique another's ideas. Use these activities to build up the computer center as a school resource for other teachers, showing them what support a computer can be in easing their workload and in providing students ways to apply their computer skills.

4. Try linking computers to careers so that students must think ahead and analyze how they might use their computer skills in the future. Ask students to write a three-part essay or give a talk dealing with these ideas: (a) What I Plan to Do in the Future, (b) What Role a Computer Will Probably Play in This Plan, and (c) How I Can Prepare for That Career. If there are students who do not believe that the computer will affect their careers, use those careers as the basis for a discussion and have the class talk about possible uses.

5. As part of an assignment, have advanced students suggest activities that require the practical application of computer technology. Have students share the better ideas with the rest of the class. Try out and refine these ideas for use with future classes.

Assessment Determine whether your computer activities have become more relevant to the present and future needs and interests of your students.

1. Ask students and other teachers to evaluate the new activities. Are they relevant to the class goals? practical? enjoyable? Hold a brief discussion with the class about these questions.

2. Solicit comments from your colleagues and students about the practicality of computer activities in your class. Invite your colleagues to participate in various activities and to relate the activities to their areas of expertise.

References: The reference for the first awareness strategy is Becky Fischl, "Computer Scavenger Hunt," in Computer Using Educators, September 1984, p. 11.

A game involving giving directions for making a peanut butter and jelly sandwich is described in Lynne Alper and Meg Holmberg's book Parents, Kids, and Computers, published by SYBEX, Inc., Berkeley, CA, 1984.

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Bias against females and minorities in software and advertising

A marketing group reinforced stereotypes by suggesting pink computers as appealing to females.

An analysis of the advertisements in a September 1984 issue of a magazine for microcomputer users revealed 11 ads featuring men only (73%), 2 ads featuring women only (13%), and 2 ads featuring both men and women. Of the latter, 1 had about an equal number of men and women; the other showed 4 computer users: 3 male and 1 female.

A software company has a line of programs called Women's Ware that its press release said would be useful for "keeping track of the man in your life." The software is directed to "the women in the home" and is packaged on a hanger and folded like a pair of slacks.

A magazine for computer users in education featured an editorial on equity in computer use and a cover showing five kindergarteners using a computer. All five were boys.

TV ad: Two middle-class parents are discussing their son's difficulties with math. They are puzzled by his failure to do as well as another boy because they know their son is smarter. Then they realize the difference: the other boy has a home computer. Happy ending: The father tells the son not to worry; the parents are buying a home computer. Implication: the boy will become a math--and computer--whiz.

Examples such as the ones above abound in the literature about educational equity and computers. The popular press, computer catalogues, and advertising show more men than women and few minority members of either sex using computers. They also tend to depict white males as technology experts. The message implicit in many ads is that, given the opportunity to use a computer, every male will become a computer expert, engrossed and challenged by this incredible machine. In addition, available software is often male-oriented: witness the profusion of violent, shoot-'em-up games in homes and arcades. Educators can work to minimize the bias, misrepresentation, and unrealistic expectations promoted by the media.

Appraisal/ Awareness Determine the extent to which bias in computer software and advertising influences or is noticed by students in your classroom. Help students become aware of this bias.

Here are some suggestions.

1. As a class project, have groups of students examine software catalogs, television ads, and computer magazines. Ask them to tally the number of times males and females and minority members appear in the illustrations or write-ups. Post the tallies on the board and use them as the basis for a class discussion. What are the findings? Pinpoint the stereotypic notions apparent in the ads.

2. Have your students use the form below to examine software or ads for bias. (You can add questions of your own)

	Yes	No
Is it action oriented? (fast moving)		
Do the graphics include violence? (hitting, bombing, destroying or injuring people or things)		
Is there an emphasis on competition? (getting points or high scores, reaching specific goals)		
Are more males than females shown or used in examples?		
Does the language refer mainly to males? (boy, man, he, or him)		
Are the symbols and images mainly male? (boys/men, race cars, rockets, tanks)		
Is only one culture shown?		
Is only one race shown?		
Are the women in passive roles rather than active ones? (standing in the background, silently watching males)		
Does it suggest that it will solve all the buyer's problems ("You can put your whole library card catalog in it") with no mention of the time or effort this would take?		

3. Discuss with students how the biases and stereotypes they found might affect their own self-images relating to computers and their futures.

Action Implement strategies to compensate for misrepresentation found in software and media presentations involving computers.

Here are some strategies.

1. As an individual or group activity, have your students pretend that they are software developers or ad writers. Have them choose a video game they know, an education game they have played, a television or magazine ad for computers they have seen, or a software package in a catalog you have at the school, and redesign it so that it is free of bias. When they have finished, they should apply the Appraisal evaluation form to it and be able to show a lack of bias. Let them share their "designs" with other class members through displays, oral presentations, or class discussions.

2. Divide the class into small groups of four or five students (boys and girls), and ask each group to choose software they would like to see added to the school's collection. (Have several software catalogs available for them to review.) Instruct them to be ready to defend their choice in class against charges of misrepresentation and bias. After each group has presented its choice, have the class vote for their favorite. Present the results to the person who buys software for your school.

3. Ask each student to find a blatant example of misrepresentation or bias found in computer ads and software. Have one or more students write a letter to the computer firm or the advertiser, expressing their feelings and pointing out the shortcomings of the product.

4. Share the evaluation form or tally results with other teachers, and see if they can suggest ways this bias is reflected in their textbooks or other materials.

5. Obtain copies of the school or district evaluation forms for software. Is there a means for detecting and avoiding bias? If not, raise the issue with the person responsible for this policy and try to get the policy changed.

Assessment Determine whether your strategies have increased awareness of the bias and misrepresentation in computer software and advertising.

Here are some possibilities.

1. Listen to your students. Have their reactions to ads and software changed at all? Start a bulletin board of examples of blatant bias, heading it with a question like, What's Going on Here? or What's Wrong with This? Note student reaction to this also. Have students brought in examples voluntarily? You could make this an on-going activity.

2. Examine (or re-examine) the school or district evaluation forms for software. Are any changes apparent? If not, how might you raise the issue of bias?

3. Do a check on yourself periodically. Are you still calling students' and teachers' attention to inequities in ads and software?

Reference: For more information on sexism in software and software bias, see Glenn Fisher's article, "Access to Computers" on pp. 24-27 of The Computer Teacher, April 1984.

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Prerequisites irrelevant for computer access and instruction

At a junior high school, 242 students signed up for 150 spots in an elective programming class. The school screened students on the basis of their math scores, citing other schools' experience that a correlation exists between math ability and programming ability.

At mid-year, a second-grade boy had not yet been allowed to use the computer in his classroom. Before being allowed to use it, students had to be reading at grade level, and the teacher assigned classroom reading books according to reading ability. "If you are a poor reader, you are reading a first-grade level book. If you are a good reader, you are reading a second-grade level book." The boy was still reading first-grade level books, and his reading level was not improving very fast. It seemed unlikely that he would get to use the computer at all that year.

In an elementary school classroom, students were allowed to use the computer only after all of their classroom assignments were completed. If you finished quickly, you could work on the computer often; if you were slow, you seldom, if ever, got to use it.

In response to requests from parents for more computer classes, one school decided to offer extra classes at a fee of $25-30 per student to cover additional teaching costs. The school is located in a low socio-economic area, and it is likely that many students will not be financially able to take the class.

The policies reflected in these illustrations show that students may be denied access to computers for reasons unrelated to interest or ability. In the primary grades, computer time is often used as a reward or incentive, and is not integrated in the curriculum. In the upper grades, inappropriate prerequisites often limit the number of students in computer classes when demand exceeds available resources. In addition, students may be unable to use computers because of fees for after-school classes or other policies that are not computer-related. This issue is complex, but the consequences of these limitations should be examined in terms of instructional goals and outcomes.

Appraisal Determine whether artificial "gates" limit student access to computers.

Here are some possibilities.

1. Assess the extent to which irrelevant barriers prevent students in your school from using computers. Consider the following:

   - Academic requirements unrelated to computers, such as being unable to use computers before all other work is done, or reading competency requirements
   - Excessive or irrelevant academic prerequisites, such as math or typing
   - Use of computer time as a reward or incentive for unrelated activities
   - Assessment of course fees, unaffordable by some students
   - Other unrelated barriers

2. Review the results of survey questions #2 and 4. Are students aware of prerequisites and do they perceive them as valid, relevant, or beneficial?

3. Examine school policy regarding enrollment in computer classes, paying special attention to course prerequisites. Do prerequisites exist? If so, how do they affect enrollment? What bearing do they have on instructional intent?

4. Interview a small sample of students who have taken the computer classes offered in your school. Ask them what skills they think they needed to have before taking the classes and what skills they used in doing the course work. Do their responses correspond to the prerequisites established by your school?

Awareness Help administrative and teaching staff become aware of any irrelevant barriers to students using and learning about computers in your school.

Here's a suggestion.

At a faculty or administrators' meeting, share the results of your Appraisal activities. Identify all of the barriers you found. Provide some clear illustrations of each problem, drawn from your survey or from discussions with students. Ask staff to react to your findings, indicating their level of awareness and concern, and to make suggestions for changes to rectify the situation. Be sure to analyze the relevance of each barrier thoroughly--some may be justified--and to consider reasonable alternatives.

Action Try to eliminate unnecessary requirements that limit student access to computers.

Here are some strategies.

1. Re-evaluate any existing academic prerequisites for computer classes and eliminate all but the most relevant and essential--for example, basic keyboard knowledge might be required before a student could learn to program; however, a geometry class may have little relevance at all.

2. Make an effort to downplay the role of mathematics. Often a mathematics course is an unnecessary and discriminatory requirement designed to make the selection process easier. If math is truly necessary, provide extra math tutors for those who need it. Provide both male and female tutors, and let all students know that tutoring is available. (Teachers have mentioned that this extra support and encouragement goes a long way toward making a student's initial computer experience successful.)

3. If your prerequisites are based on the need to limit enrollment in computer classes, examine these possibilities:

   - Give enrollment priority to the oldest students in your school, and fill remaining places with students from the next oldest grade.

   - Offer short, introductory computer courses that are open to all students. Make enrollment in follow-up courses contingent on performance and interest in the introductory course.

   - Have students fill out applications for each computer course, describing their reasons for wanting to take the course. In evaluating the applications, try to focus on the students' motivation and potential.

   - Establish some other guidelines for admitting students, such as teacher recommendation. Whatever procedure you use to limit student enrollment, make it fair, equitable, and well known. Be sure that the limitations are not artificial ones.

4. Make detailed information about available computer courses and prerequisites available to prospective students well in advance of the first class to allay their fears and prepare them better. Include course requirements, an outline, teaching techniques (self-paced, tutor, lecture, etc.), examples of projects, and other helpful descriptive information. Let students know about any potential barriers to their participating. Provide the same information to parents, so that they can become involved in their children's computer education.

5. If computers are intended to be an integral part of your school curriculum, then include them as such. Eliminate any requirement that students have all other academic work completed or done at a specified level of competency before they can work with the computer. (You would not use math problems as a reward for having work completed, so why computers?)

6. If course fees must be assessed for after-school classes, try to make scholarships available to interested students who cannot afford the fees. Or plan fund-raising events to support the expenses.

Assessment Examine the results of your efforts to eliminate unnecessary requirements for using computers.

Here are some ideas.

1. Using the list of barriers you made earlier, determine whether any have been eliminated or modified. Which, if any? What effect have the changes had?

2. Poll students and educators at your school to assess the effects of your actions. Are more students becoming involved with computers because of your actions or for some other reason? Have you succeeded in changing any policies, attitudes, or behaviors among your school staff? How have the students benefited?

3. Ask all students to complete course evaluations that specifically assess the effectiveness of these changes. Compare each class's responses. What suggestions do students have for future changes? Do they feel they have adequate opportunity to use computers?

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Limited computer access for females during free time at school

Jill and April went to the computer lab at lunch, hoping to practice their BASIC programming. A large group of boys had already arrived and were crowded near the door. When the teacher opened the lab door, the boys rushed in and occupied all the computers before Jill and April could get to one.

Kathy came to the computer lab after school to work on a Logo assignment. Because she arrived about 15 minutes late, she was unable to get a machine immediately. She waited around for 20 minutes but left because all of the computers were still occupied.

A school had a sign-up sheet for using the computers during free periods. The teacher noticed, however, that while the boys readily penciled in their names, some girls tended to ask the teacher if there would be room for them before signing up. Consequently, the sign-up sheet was filled before these girls decided to put their names down.

Dana, a seventh-grade girl, had to discontinue visiting the computer lab after school because of her responsibility for watching the new baby at home. This is only one of several chores she must complete after school because her mother works.

These examples illustrate some problems involved in providing equal access to computers during non-instructional time. Whether the problems are rooted in the dominant-passive behavior patterns of students or in the limited resources provided by the schools, educators can work to increase and equalize access to computers during free time.

Appraisal Determine what barriers, if any, exist for some students to use computers during free periods at your school.

Here are some ideas.

1. Review the results of survey question #10 to determine the extent to which students use or would use computers during free time. Do students perceive availability accurately? What conditions encourage or prevent students from using computers?

2. Observe students as they come into the computer lab during free periods. Focus on one student at a time and check all of the columns on the chart below that describe that student:

				Works in Lab		Finds Computer to Use		Fails to Get Computer			
Boy	Girl	Runs In	Walks	Often	Rarely	Takes First Available	Joins Someone Already At One	Leaves	Complains	Waits Turn	Other

Mark this chart for several days, and observe as many different students as you can. Add up the totals for each column, and review the data. Are any patterns apparent? For example, are more boys than girls using the lab? Do boys tend to rush in and take the first available computers? Do some students wait to find partners? Do some students leave the lab because they cannot get a computer?

2. For a five-day period (or longer, if you wish), have individual students "log in" and "log out" of the computer lab. Provide a log sheet where they can record when they arrived, when they got a computer to use, and when they left. Be sure to include students who come to the lab but are unable to find a computer to use. Review the results to see whether any patterns, like those mentioned in the preceding activity, appear.

Awareness Help students become aware of how their behavior may limit student access to computers during free periods.

Here are some suggestions.

Discuss the results of the survey and appraisal activities with your class in the following ways:

1. Discuss reasons why some students are more or less inclined to use computers during free time than others. Identify situations that seem to encourage or discourage students from using them.

2. Share your observations about how students use computers in the lab. Cite both positive and negative behaviors observed--for example, assertive behaviors that enabled some students to find a computer; passive behaviors that prevented others from doing so, etc. Discuss how students can learn from each other and can create more equitable use of computers during free periods.

Action Make the computer lab more accessible to all students during free periods.

Here are some strategies.

1. Distribute "tickets" of different colors to all students who want to use the lab (or who are enrolled in computer classes). Use the ticket colors to regulate access to the lab. For example, students with yellow tickets could be admitted first on Mondays, and students with tickets of other colors could fill any leftover spaces. Students with blue tickets could be admitted first on Tuesdays, etc. You could issue only two colors of tickets and use them on alternate days, before and after school, or for the first and second half of the lunch period. Change the pattern to give everyone a chance.

2. Reserve some computers for girls and some for boys. You can use this technique on a first-come, first-served basis during free periods, or you can have students sign up ahead of time.

3. Set aside one day of the week for boys to use the lab exclusively and another day for girls. It may take some time for students to take advantage of this policy, so give it a trial period of six weeks or more before you decde to alter it. Publicize the policy and place a poster in the lab to remind students of the "Boys Only" and "Girls Only" days.

4. Alter the environment in the computer lab so that it appeals to all students. If the focus is mainly on males (violent games, male-dominated graphics or art), try to include software activities and bulletin board materials that interest girls as well. Ask the girls to suggest ideas for creating a comfortable environment.

Assessment Determine whether your actions have resulted in increased use of the computer lab during free periods by students--particularly girls--who previously did not use the lab.

Here are some ideas.

1. Observe students again, using the chart shown in the Appraisal above. Compare the most recent data to your original results. What changes appear? Are more students coming in? Are they able to get computers?

2. Tally the number of different students using the computer lab during free periods. Has the number of students using computers increased, decreased, or remained the same? Is there a difference in use by girls? Has this varied with the strategies used?

3. Review each strategy you tried. Did some work better than others? Why do you think this is so? Ask some other teachers to try the same strategies and compare notes.

4. Pick out some of the students who have started using the computer lab since you used these strategies. Ask them why they are now using the free period for computer activities.

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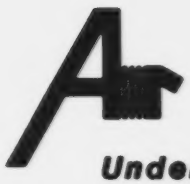

Underrepresentation of females and minority students in computer clubs

Of the ninth grade girls in three different programming classes, not one was interested in joining the computer club. None of these girls knew anyone in the club, but they said that the club members were "narrow-minded" and interested in "nothing but computers." The girls did not want to join the club, saying there was little to be gained from being a member "unless you want to copy and exchange illegal software."

Girls at another school were turned off by the activities of the computer club. "All anyone does there," they complained, "is write programs or play dumb games."

Several other girls at the same school said that they could not attend the computer club meetings because they had to go straight home after school.

Teachers at an elementary school were asked to nominate three of their best computer students to be in the computer club, and they asked students to sign up to be considered. More boys expressed interest than did girls, and girls were not encouraged to sign up.

Computer clubs are unappealing to many girls because of a number of reasons. Reasons reflected in these illustrations include lack of relevant and interesting activities, conflicting after-school commitments, and lack of encouragement from others. Peer pressure and limited access to computers during free time (both discussed elsewhere in IDEAS) also contribute to the problem. Computer clubs are often unappealing to minority students also. By failing to participate in such clubs, however, students lose valuable learning experiences with computers and reduce subsequent opportunities for work in computer-related fields. Educators can address the problem by recruiting girls and minority students to join computer clubs, and by organizing the clubs so that all kinds of students want to join and remain involved in them.

Appraisal/ Awareness Determine which students belong or are interested in computer clubs and why.

Here are some ideas.

1. If your school has a computer club, identify its current members. Identify non-members who have taken or are taking computer classes. How many members and non-members are male, female, or minority? You might want to record your count on a simple table like this:

	Members		Non-Members	
	#	%	#	%
Male Female Minority				

2. Review the results of survey question #17 regarding computer club membership and activities. Share the results with students and teachers. Try to identify factors that discourage or facilitate interest and membership in the clubs. See how widespread the reported feelings are by discussing them informally with other students and teachers.

3. Assess club activities. Write down a detailed list of club activities, for instance, formal and informal topics of discussion and patterns of interaction and behavior. Take the perspective of a girl or minority student and ask yourself if any of these activities would discourage you from becoming involved in the club.

4. Get another viewpoint. Ask one of the members of your staff or a perceptive student to attend a meeting of the computer club. Ask the person to observe activities, situations, and interactions and suggest how they might discourage (or encourage) the participation of some students. Share these ideas with other students and teachers. Do others agree? What changes can be made?

5. At parent meetings, solicit the ideas of parents. In the faculty room, ask your colleagues if they have heard students talking about the computer club and if so, what they have heard.

Action Change the organization and activities of the computer club to encourage more female and minority students to participate.

Here are some strategies.

1. Work with students to establish a statement of purpose and a plan of activities for the computer club that appeal to both boys and girls and to minority as well as non-minority students. Let the students know that it is their club and give them an active role in its organization.

2. Actively recruit girls and minority students in computer classes to join the club. Be sure to stress that the club's format will be responsive to the members' interests. Have a "Bring a Buddy" meeting to recruit additional members. Enlist the help of other teachers in recruiting members.

3. Encourage girls and minority students to participate in the club along with their friends or their partners in computer courses.

4. Disseminate information about the computer club through flyers handed out in class or articles in the school newspaper. Ask for ideas from readers about club activities.

5. Get parents and outsiders involved in the club. Try to include as many female and minority parents as possible. Have a parents' night where club members and parents work together on the computers, or ask the students to demonstrate their work or teach the adults. Invite any parents with computer-related jobs to visit the computer club and talk about their work.

6. Publicize initial and on-going club activities with posters and news articles. Emphasize that the club is for both boys and girls, that computer use is not a "male only" activity. Include pictures of minorities and women using computers. When your computer club attracts a wider range of students, take pictures and post them around the school.

7. Place a suggestion box in the computer lab so that students can contribute ideas when the club is formed and throughout the year. Ask students to suggest ideas on how to make the computer club more interesting and useful, and solicit their ideas about class activities as well. Post the better suggestions so that other students can read and comment on them.

8. Plan club activities that enable members to apply their computer skills to various tasks around the school. For example, members could help in the office, produce a newspaper, keep track of sports data, or maintain a school calendar. Publicize these activities and share them with other students and teachers whenever possible. Teachers may be able to suggest possible computer activities that relate to their subjects and course content.

9. Consider having one club for boys and another for girls, keeping time, opportunity, and resources equal.

Assessment Determine whether the computer club has attracted new female and minority members.

Here are some suggestions.

1. What corrective action did you take and why? How effective was it? Did your efforts recruit more boys or more girls? Were you able to attract minority students? Why?

2. Poll any new club members to see what got them interested in joining.

3. What are club members reporting about the computer club now to other students? other teachers? their parents? What is the attendance record?

4. Have you thought of any additional techniques for involving more students? What are they?

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Dominance by one student over another during computer time

> Shelley and Mike were partners. Mike prevented Shelley from entering her program by hitting the backspace key repeatedly. After some time, despite her protests, Mike assumed complete control of the keyboard, and Shelley became a non-participating observer.
>
> Wendy, a fifth grade Asian girl, shared computer time with Lisa and Joseph. Wendy never got to use the computer because the other two students monopolized the machine. Lisa and Joseph argued over who would get to use the keyboard; Joseph usually won. Wendy didn't even try to participate because she felt she could not succeed and she did not like to argue.
>
> Gloria was having problems with the computer. Jane, the computer tutor, ignored Gloria's request to correct the problem herself. Jane solved the problem, without showing Gloria how to do the work. Gloria felt inferior and, as a consequence, decided to drop programming activities.

These vignettes illustrate how one student can deny computer opportunities to another by monopolizing the computer. As these examples show, dominance may occur within a partnership, in a small group situation, or even in a tutoring relationship. Students may not be aware of the effects of their actions, which prevent others from having a fair share of learning time with the computer. Educators can reduce or eliminate instances of one student "taking over" or dominating others during computer time.

Appraisal Determine whether some students dominate other students and thereby limit the other students' computer learning.

Here are some ideas.

1. Take time to observe student interactions at the computers. Watch for situations when students work individually, in pairs, or in groups, paying special attention to dominant and passive behaviors. Use the attached sheet to record your observations.

2. Review student responses to survey question #13 about what they most and least like about doing computer work with a partner, with a small group, or alone. Is there any evidence that these students feel dominated by other students when they work in pairs or groups?

Awareness Help students become aware of how their actions reduce other students' opportunities to learn about the computer.

Here are some strategies.

1. Share the survey findings with the class. Discuss possible reasons for their preferences and the advantages and disadvantages of working in each way. Emphasize the ideas of fairness and equal time. Ask students to imagine how they would feel if another student(s) took over their computer time. Discuss the harmful effects of such dominant behavior.

2. Ask students to assess how they see themselves in different learning situations. Use the same behavior categories you used earlier to observe student interactions.

3. Create role-play situations that illustrate fair and unfair behaviors that the entire class can observe. For example, have one student jump up to allow someone else to have a turn on the computer. Have another student in a group of 3 or 4 monopolize the terminal. Discuss these situations and their effects on students. Why is it important for everyone to have a chance to become familiar with the keyboard? What happens when he or she does not--immediately and in the long term? Does this apply only to computers?

Action Establish appropriate guidelines and activities to reduce dominant behaviors and to facilitate more equitable learning opportunities on the computer.

Here are some suggestions.

1. Establish some rules for working in teams and in groups. For example, each person has equal time to enter a program or read the instructions. If necessary, set a timer or blow a whistle to indicate when to trade tasks. Take time periodically to explain the rules. Illustrate acceptable and unacceptable behaviors. Acceptable behaviors include taking

turns, helping each other, and allowing others to make a mistake and correct it themselves. Unacceptable behaviors are not giving up the keyboard, refusing to use the keyboard, being slow to trade tasks, and doing someone else's work.

2. Develop activities that require team or group cooperation to resolve or complete. For example, ask a team to create a graphic program. Assign specific tasks or appoint a leader to coordinate. Emphasize that this is a group effort. When the activity is finished, ask for an account of how the members worked together.

3. Reward cooperative efforts and relationships. Inform the entire class when an individual or team exhibits exemplary behaviors, and create other incentives for effective group/team behaviors--for example, allowing the group to play a game during class time.

4. Vary team partners and group members so that students learn to work with several members of the class. On occasion, allow students to choose their partners or group members.

Assessment Examine the results of your efforts to reduce dominant behaviors and to create more equitable use of the computer.

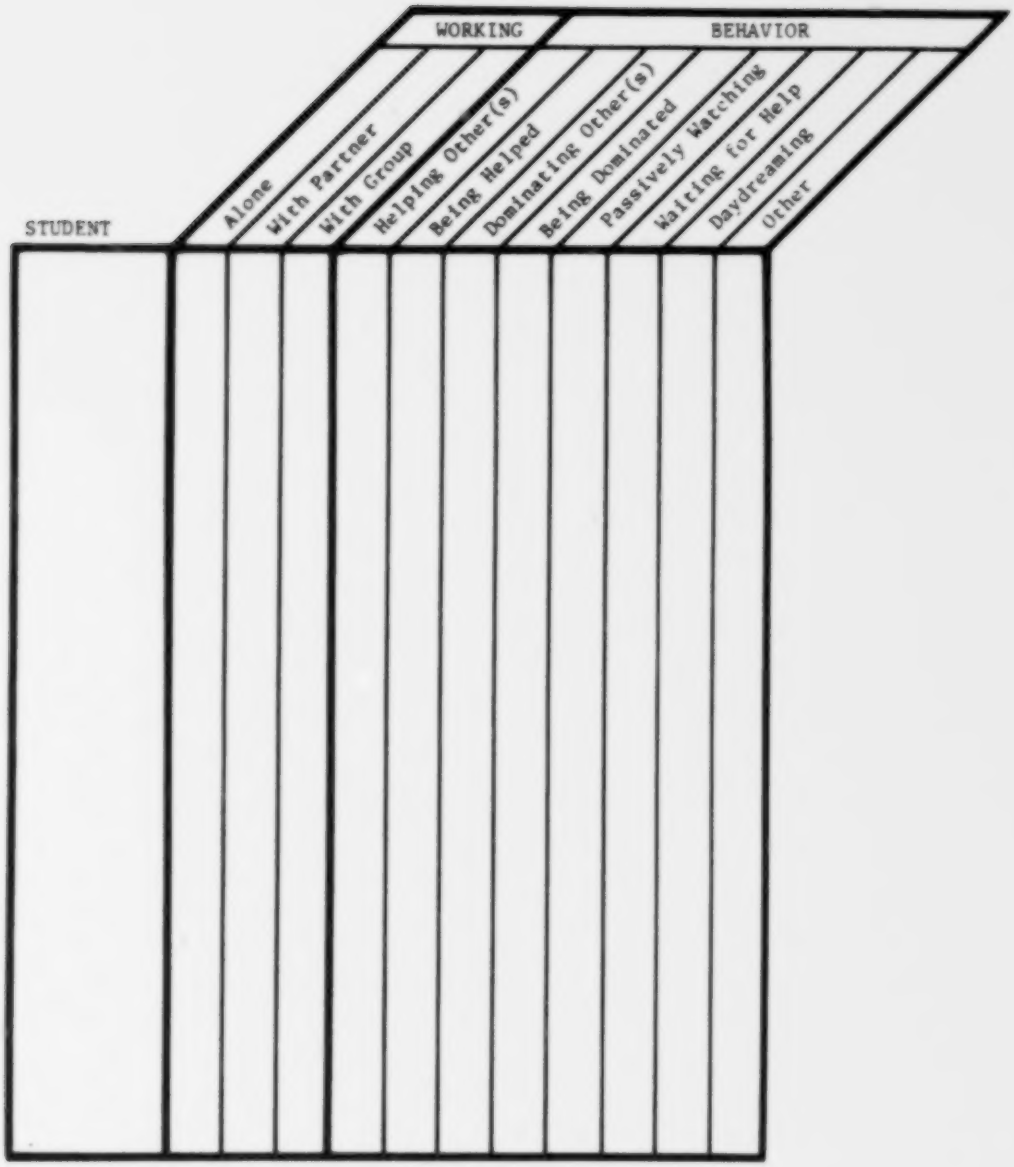
Here are some activities.

1. Use your observation sheet again. What are the differences between your first and second observations? Where do you need to emphasize corrective action? What seems to work best and why?

2. Poll the students to determine whether or not they notice differences in their own behaviors and opportunities. Has there been any change? Do students feel they can use the computer terminal without being dominated by others?

3. Take a careful look at those students who seemed to be involved less with the computers before you applied some of the "balancing" techniques. What changes do you observe?

Observation Sheet



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Pressure from peers not to participate in computer activities

Heather stated that she was "losing" most of her girl friends because she was spending a lot of time on the computer during her free period. Previously she had spent this time with her friends. She was able to resolve her problem because her parents bought a home computer, but some students do not have access to a home computer. As she admitted, "Without the home computer I wouldn't be learning as much because I was willing to give up my computer time to be with my friends."

John planned to drop out of the computer club because the time conflicted with volleyball games, and his friends urged him to play volleyball. John did not want to miss volleyball because he enjoyed both the physical activity and the social interaction it involved.

Lynne was interested in the computer club and liked to spend free time in the lab, but the other kids started calling her "a computer nerd." As she spent more time in the computer lab, she heard students say, "There goes the computer nerd." Lynne was very sensitive to these comments and finally stopped going to the computer lab after school; she attended only during class time.

These incidents illustrate conflicts students often feel between the desire to socialize with friends (and maintain their friends' esteem) and the desire to learn more about computers. Although students of both sexes experience pressure from peers, girls seem to be called "nerds" more often than boys, and participate less in computer learning as a consequence. Educators can reduce the conflicts and pressures students encounter by making more time available for computer use, by creating activities that appeal to a broader cross-section of students, and by capitalizing on the positive influences of the peer group.

Appraisal/ Awareness Determine whether any students feel peer pressure not to pursue their interest in computers. Make all students aware of this pressure.

Here are some ideas.

1. Review student responses to survey questions #2 and 3 about reasons for taking or not taking a computer class. Is there evidence of peer influence?

2. Check to see how many students are using computers during their free time. Then check responses to survey questions #10 and 11. If there are students who indicated on the survey that they would like to use computers but who are not doing so, why are they not using the computers? Are students reluctant to use computers during free time because of pressure from peers?

3. Are there students who have encountered peer pressure regarding computers and have overcome it? Solicit ideas from students in informal conversation or class discussions.

4. Establish a continuum in a number of ways including these:

   - Ask students to "vote with their feet." Indicate an imaginary line that goes from one side of the room to the other and then, for each item you present, ask each student to go to the place in line that reflects his or her opinion.

     Example: A friend of yours wants to spend lunch hours in the computer lab. Another friend says, "If you're going to the computer lab all of the time, you can just forget about being my friend." Imagine a line that goes from one opinion to the other. If you agree with the friend who wants to go to the computer lab, go stand near X (the door). If you agree with the other friend, go stand near X (the window). If you sort of agree with one and sort of agree with the other, stand somewhere in the middle, but go closer to the one you agree with more.

     After students take their places along the "line," discuss the various viewpoints, asking individual students why they have taken the "stand" they have. Ask them to suggest ways to resolve the conflict. How can the students meet their social and learning needs?

   - Give students copies of a printed continuum repeated once for each item. Ask students to mark the spot that reflects their feelings about each situation.

     Example: You really enjoy working on a computer. The kids at school have started calling you a "computer nerd." How does this make you feel? Mark this end (indicate) if it doesn't bother you at all, mark this end if it bothers you a great deal, or mark the place between the two that shows how you feel.

Use this example to discuss name-calling in general, to talk about what a "nerd" is, and to emphasize the positive connotations the term can have: intelligence, computer knowledge, dedication, and potential for future success. (You might want to point out that the two founders of Apple Computers were considered nerds by some of their classmates.)

- Draw a line on the chalkboard and ask students to place their initials on the point that best represents their view on each situation.

  Example: One of your friends wants you to stay after school to work on a computer project, and another friend asks you to play volleyball with a bunch of kids. This end of the chalk line is the friend with the computer project; this end is the friend with a volleyball game. Write your initials on the spot that shows what you would feel in this situation.

Again discuss the different viewpoints with students and ask them to think of other ways to resolve each situation.

Action Reduce the incidence and negative effects of peer pressure.

Here are some strategies.

1. Schedule additional time for computer use. For example, if the conflicts seem to occur most frequently around the lunch hour, try scheduling additional free periods in the afternoon or early mornings.

2. Appeal to social groups of students to use computers together. Encourage students to take turns choosing activities, being sure to include computers. Try counseling one-on-one or with small groups to resolve conflicts.

3. Make computer activities more stimulating and interesting during free periods. Try to relate students' social activities to their computer activities. For example, if some students enjoy volleyball, have them keep scores and results of the games on the computer. Select educational games that are similar to the games played on the field. This particular strategy can help involve many more girls in computer-related activities because it establishes a direct link between their extracurricular activities and computer technology. Try to offer a variety of activities: games, programming, graphics, and word processing.

4. Try to make "nerd" a complimentary or positive term rather than a negative one. With newspaper articles or bulletin board displays, publicize the highly successful "nerds" of the computer world and show what their expertise has enabled them to achieve. Again try to include women and minority group members in these features.

5. Identify any students who might be considered "nerds" by others. Try pairing these students with others to complete an interesting computer activity.

Assessment Determine whether peer pressure against participation in computer activities has decreased.

Here are some suggestions.

1. Check the use of computers during free time once again and observe the students. Are more students using the computers than before? Are more working in groups? Does peer pressure have any influence on their presence?

2. Verify your conclusions by chatting informally with students who are participating in computer activities. Ask questions like "Do your friends come here too?" Try to determine whether students are resisting peer pressure more or whether the pressures have subsided.

3. Check with students who show interest but are still not participating in computer activities. Is peer influence the reason?

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Underrepresentation of females in computer leadership roles

A teacher at an elementary and junior high school wanted to have an equal number of boys and girls as computer assistants. She knew that three girls in her class already had completed a summer computer program and were very good students. Each of the girls declined the opportunity to become assistants, despite the teacher's efforts to the contrary. Consequently, all of the computer assistants at the school are boys.

Teachers at a junior high school chose six to eight eighth-grade computer tutors each year. They selected only boys, who were "more knowledgeable and responsible." They never even considered the girls.

Three eighth-grade girls had strong computer skills before enrolling in the school's computer course, having taken after-school computer classes. However, they never volunteered to help anyone, and no one asked them for help. They seemed reluctant to demonstrate their skills and fearful that they would be considered "show-offs." A boy in the class was eager to be class expert, and the others deferred to him.

These examples illustrate that females may be reluctant to be "experts" or leaders when it comes to computer learning. People in a position to select or encourage students to assume leadership roles often share this reluctance to encourage female involvement. Consequently, boys greatly outnumber girls in positions as computer tutors, assistants, and leaders. Increasing the number of female leaders is important so that girls can serve as role models and encourage other girls to become interested and involved in computer learning. Having female leaders also helps to erode the stereotype that computers are primarily for boys.

Appraisal Determine the extent to which females assume or do not assume leadership roles in computer activities.

Here are some ideas.

1. Ask all staff members in the computer center to keep a tally of student leadership: instances in which a student initiated an activity, led a group activity, volunteered to tutor, or demonstrated leadership in some other way in computer activities. Give staff members a two-column sheet: one column for females and one for males. Instruct them to put a mark in the appropriate column each time they see a student demonstrate leadership or help another student. Tally the marks. If tutors and assistants have been appointed, add marks for them. Compare your data to the ratio of boys to girls in the computer program.

2. Review student responses to survey questions #15 and 16 about student helpers. How many students readily accept help from girls? boys? either? How do students feel about helping others?

Awareness Develop awareness among students about student attitudes toward computer leadership roles.

Here are some possibilities.

1. Share the findings from the appraisal activities with the students. Present the findings without reference to gender. Lead a discussion of these questions: How do you feel about these results? How do you think most boys responded? girls? In what ways do you think boys and girls agreed? How could these results affect your computer work?

2. Convene an informal gathering of girls, including a number of leaders and potential tutors and assistants. Share the findings of the appraisal and solicit their ideas about how girls might be encouraged to assume tutoring and leadership roles with computers.

Action Provide incentives for girls to become computer leaders, tutors, or assistants.

Here are some suggestions.

1. Establish the role of leader as something everyone must do as part of the class assignment. Give the leader specific responsibilities such as being a tutor or leading a group activity. Have each student be leader for a one-week period. Or, if you think students would gain ideas and confidence from watching others, set the period for two or three days and allow for second "terms" after everyone has had a turn. Be sure to include every student. Publicize the name of the leader by posting it on the board or by giving the leader a special button or name tag to wear.

2. Make the position of computer leader, tutor, or assistant appealing to girls by letting girls have some role in defining what that person does. You can get this information from the appraisal activities mentioned above or from class discussions. Once girls accept this role, they can assume additional responsibilities as well.

3. Add prestige to the positions of computer leader, tutor, and assistant through peer recognition. Allot an equal number of positions for boys and girls. Let the boys and girls vote for members of their own gender. Or, pick the first tutors yourself from those you feel would do the best job. Select students who are popular and knowledgeable about computers in order to enhance the prestige of the position.

4. As a reward for serving as computer leaders, tutors, or assistants, give students extra time on the computer for their own activities.

5. Present awards or recognition for outstanding computer leaders, tutors, or assistants. These awards can be ribbons or certificates that are hung in the computer center, or a poster with the name and photo of the recipient for an award like Tutor of the Week.

6. Create temporary or rotating positions for computer leaders and assistants. Ask girls to volunteer for these positions for the experience. If they decide they like the position, they can volunteer for an on-going tutoring job.

Assessment Review the results of your efforts to recruit girls to positions of computer leadership.

Here are some suggestions.

1. Since you began this effort, how many girls have assumed roles as computer leaders, tutors, or assistants?

2. Ask new female tutors what factors led to their decision to become tutors. Did any of these factors relate to your efforts? If not, can you incorporate them into new strategies?

3. Which of your strategies worked best and why? How can they be improved?

Inappropriate location of computers within schools

One junior high school had 15 computers in a lab used for computer instruction. However, when classes were not in session, the lab was usually locked, due to a shortage of personnel for supervising use of the computers. Consequently, students could not use the machines.

An elementary school had assigned some of its computers to specific classrooms or teachers. These computers were often idle or not fully utilized. Because they were not on mobile carts, they could not be used in other locations by students or teachers who had available time.

Each classroom in an elementary school had one computer. In John's class, students were given a giraffe (sticker) when they turned in groups of completed assignments. When they had four giraffes, they were entitled to an hour of computer time to play educational games. With "giraffe" time and regularly scheduled computer activities, the computer was always in use, and the class could have used several more. In Ann's class, across the hall, the teacher made no provision for computer activities, and the computer was almost never used.

In a junior high school all of the school's computers were kept in a math teacher's classroom. Only the teacher and students in this classroom were able to use the computers.

These illustrations show that students sometimes cannot use computers because of their location within the school. In several examples, the location problem is related to a shortage of personnel or to reluctance of staff to use the computers. Without altering staff, you might be able to increase access to computers by simply analyzing the present utilization of your school's computers and changing their location. Of course, if determining where computers are located is not in your area of responsibility, you will need to coordinate any change with appropriate administrative staff.

Appraisal Determine whether the location of computers in your school limits their use.

Here are some activities.

1. Find out where each computer in your school is located. Plot the use of each computer for a period of several days or a week. (Put a log sheet at each terminal and ask every user to "log in.") Identify computers that are underutilized, fully utilized, and perhaps even overutilized.

2. Review the results of survey question #12 to see whether students have identified specific location problems. Do they match your log findings?

3. After analyzing the degree to which each computer is used, try to identify reasons for the differences among them. Watch for departmental turf (a clue to limited access), or teacher phobia toward computers. Look for other location-linked barriers. Does school policy have any bearing on this?

Awareness Develop awareness among staff and students about how the location of the school's computers can affect their use.

Here are some ideas.

1. Share the findings from the activities above with staff and students. Help them identify reasons why some locations provide better access to computers than others. Ask students which locations they prefer. Discuss the advantages and disadvantages of various locations, and assess the feasibility of relocating computers to maximize their use.

2. Distribute school maps to your students. Have them place an X at each location where they would like to use a computer. You might also have them rank order their preferences. Compile this information into a bar graph or some other visual form to show patterns of preferences (e.g., for boys, girls). (Perhaps a student could do this as a computer class activity.) Discuss your findings with students, teachers, and administrators. Try to identify changes that could be made to increase access to computers.

Action Locate the computers in your school to ensure maximum access and use by students.

Here are some suggestions.

1. Relocate the computers you previously identified as being underutilized. Move them to locations where they will most likely be used more. Try some of the locations students claimed to prefer and locations that seem to be in heavy demand already.

2. Experiment with different locations. Move a few computers to a place that is near student activity centers or one that students frequently pass. Keep track of use in each location.

3. Put computers on mobile carts to improve student access. You can move the computers quickly to other locations as needed.

4. Put a few computers in the library. Set a maximum time limit or use a sign-up sheet so that the machines are not monopolized by some students.

If adequate supervision is available, try some of these ideas:

5. Establish mini-labs of three or four computers each in different rooms. These mini-labs may appeal more to some students and are easier for teachers to monitor and work with than larger centers.

6. Establish separate computer labs for boys and girls to encourage more students to participate. Girls, for instance, would no longer have to compete with boys for machines and may be more willing to use the computers in areas specifically designated for them.

7. Establish separate labs for different purposes. For instance, one location may be for programming while another is for word processing, CAI, or graphics.

Assessment Examine the results of your efforts to increase or equalize computer use by relocating computers.

Here are some activities.

1. Plot the use of the computers that have been relocated over a period of time. Has computer use increased or decreased as a result? Do the new locations draw different students or merely the same students as previous locations? How often are the relocated computers used? Is there a difference in the ratio of boys to girls among users compared with the previous location?

2. What different types of student behavior or computer use have resulted from the moves? What are the positive and negative outcomes of these changes?

3. Ask students if they notice any differences in the numbers and types of students using the new locations, any changes in their own behavior, and any differences in the types of computer use. Discuss the implications of these changes and assess whether further changes are needed.

Inability of teachers and students to recognize and deal with problems in computer learning

John said that he didn't need to know very much about the computer because his partner, Jim, was very knowledgeable and Jim performed all the tasks for their assignment each day. John found this arrangement satisfactory, and the teacher did not notice that Jim did all of the work.

Jenny sat alone at a computer for about ten minutes without making any input to her program. She said that her regular partner was absent, and she didn't know how to work out her problem. The teacher was too busy to notice. Rather than ask for help, Jenny was content to wait until her partner returned to solve her problem.

Dina and Tim were working a Logo problem for their fourth grade class. They were not sure how to proceed at one point. Rather than ask the teacher or one of the class tutors for help, they glanced at other students' programs, hoping to find the answer, and wasted most of a class period.

During one 20-minute period, only Robert, a team member, used the computer keyboard. His partner Susan did not know how to type and was not comfortable touching the keyboard, so she preferred to read the instructions to Robert. The teacher did not notice or attempt to change the situation.

Carol and David were trying to work out a loop program in BASIC. They were not having much success and were beginning to lose their concentration and interest. When asked why they didn't ask for assistance, they replied that they didn't really know what question to ask and didn't want to appear foolish.

As these examples illustrate, teachers and students sometimes have difficulty identifying learning problems in the classroom and fail to offer or seek help in solving these problems. Just as some students have better computer skills than others, some are also more willing to solve or seek help in solving learning difficulties. Similarly, some teachers are better able than others to recognize and effectively deal with problems when they occur. Many of the students in these examples, like Jenny, are passive, dependent, or self-conscious about seeking help. Many of the teachers do not perceive the students' needs and consequently do not act to correct the situation. Although it is difficult to monitor individual progress, teachers and assistants can help students make the best use of their computer time and ensure that students have the resources to deal with problems they encounter.

Appraisal Determine the extent to which teachers and teaching assistants do not recognize and meet the needs of students who have problems on the computer; determine the extent to which students are reluctant or unwilling to request help for their problems.

Here are some ideas.

1. Observe students to determine how they work out problems on the computer, either individually or in groups. If you have computer assistants, train them to observe the students as well. Keep track of the different ways students try to resolve their problems. For example, keep a tally for P (asking peers for help), A (asking aides for help), T (asking teacher for help), or N (not asking anyone for help). Which behaviors occur most often? Note whether particular students ask for help, are asked for help, or do not ask for help. If such patterns exist, why? How might you reduce instances in which students with problems do not seek help?

2. Observe your students and take a close look at how they are paired or grouped. Two shy or slow students may be reluctant to ask for needed help or may have difficulty framing the problem. Pay special attention to situations where one student does all of the work. Note conditions that might contribute to the students' reluctance or inability to seek help. Verify your observations by talking with students.

3. Review the results of survey question #14. Do students' perceptions of their own approach to problems match your own observations in class? Are some students more effective than others in seeking help? Why and how?

4. Take a close look at your helpers. Are your aides or student tutors accessible and knowledgeable? Do they recognize when students are having difficulty? Do they provide assistance or just give answers? Do they help students learn? Are they tolerant of students who have difficulty or fail to understand explanations quickly?

Awareness Help teaching staff and students become more aware of the need to recognize learning problems and to seek and provide help for solving problems.

Here are some suggestions.

1. If possible, record one or two of your lab sessions on video- or audio-tape. (If there is an audiovisual class or aide, get assistance from them.) In making the recording, focus on computer activities during class. Review the tape later to identify problems in teaching or learning behaviors. If problems are obvious, you can use the recording to make your assistants and/or students aware of the problems and to consider solutions. You can also ask a colleague to review the recording and offer comments and suggestions.

2. Hold an orientation session with aides and tutors to discuss how and why some students seek assistance with computer problems while others do not.

Impress upon the assistants that some students have different needs than others. For instance, if the tutor notices that a student has stopped working before the task or assignment is complete, the tutor may need to say, "How are you coming on this assignment?" rather than wait for the student to ask for help. Encourage assistants to help students work through the problem and discover the answer themselves, not just do the problem for them.

Action Create an environment that encourages students to seek help in solving their learning problems and that provides students with help as needed.

Here are some strategies.

1. Try different ways of grouping your students for their computer work.

   - Group students so that there is at least one person who is assertive enough to take the lead in asking for help when needed.

   - Group students with different abilities in order to provide some leadership for the group.

   - Use a random system for pairing. Count your students aloud and assign each student that number. Put each number on a slip of paper and place the slips in a box. Have two numbers drawn and called out at a time: students holding those two numbers are paired. Change the pairs periodically.

2. Some students like to help others. Identify those students (see survey question #15) and assign them to one or more groups of students who need help. Have these teaching assistants remain accessible to the remainder of the class as well.

3. If you notice that one particular student is doing all of the work in a group, remove that student from the group for a day or two. Make it a positive situation, however. You can use him or her as an aide for these days, and the remaining student(s) can continue computer activities either alone or with others.

4. If you made a videotape or audio recording for the Appraisal objective, share it with your assistants and/or students. Point out both positive and negative examples of work habits; for example, "Notice that Lee didn't get a chance to work here... Look at how well these two pairs work together... Notice that this assistant didn't just take over, she showed the student how to solve the problem." If you didn't make a recording, you can at least reinforce effective behaviors: "Good, Terry. You offered just enough help so that Paul could figure out how to solve his problem."

5. Encourage students to seek help from each other. Have students working in a group agree that everyone will attempt to solve a problem before turning to the teacher.

6. Encourage students to seek help when they need it, and make sure that help is available. For instance, use a Help-Needed sign-up sheet; be sure to provide help to students in the order in which they signed up. You can also arrange an extra practice session during a free period for students who need it. You can give some form of recognition to students who show great improvement, such as a certificate for "Most Improved Computer User," to be placed on the bulletin board. You can also make these students group leaders or tutors where appropriate.

Assessment Determine whether students are asking for and receiving the help they need to solve learning problems on the computer.

Here are some possibilities.

1. Observe your class again to see how well students are working now. Are there still individual students who let others do all the work? Are students asking for help when they have difficulties? Are you and your assistants available to provide the needed help? Are you giving encouragement and guidance without just doing the work for students?

2. Have tutors and assistants provide feedback on how well your strategies are working with the whole class or with particular groups of students. Are additional strategies needed?

3. Compare the results of your strategies from one class with your other classes. Is there a difference between classes? Do some strategies work better with different classes? Try to write down and analyze reasons for any differences.

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Shortage of qualified personnel for computer learning

The computer coordinator at a junior high school has no aides. The only time students can gain extra access to the computers is before or after school or during lunch time. There are many students who want to use the computers, but the coordinator is tired of coming early, staying late, or missing lunch.

An elementary school teacher took her class to the computer lab each Monday, Wednesday, and Friday, but only when the computer teacher was there. The classroom teacher reasoned that if something went wrong on a program and she could not solve the problem, she would look foolish in front of her students. When the computer teacher was out of the lab for two weeks, the students had no computer work.

An elementary school received six computers only to find that no staff members were willing or able to teach computer classes. In addition, the school lacked the funds to hire a person specifically to teach computer classes. Consequently the computers sat idle until the school's parent association donated the funds to hire a person to teach Logo.

An elementary and junior high school with 10 computers recently had to drop the before- and after-school computer program because no faculty member was free to monitor the activities. The two teachers who run the school's computer program said they were simply too busy with other commitments to offer more computer activities.

Limited resources are manifested in a number of ways, including lack of free time activities, few class offerings, shortage of computer time per student, and enrollment restrictions. These limitations may result from staff problems such as lack of time, perceived lack of knowledge, or computer phobia. Teachers may refuse to use computers in class or to participate in extra computer activities. They may be reluctant to learn to use computers, or simply lack the opportunity to learn and hence be unable to teach others. Whatever the cause, a shortage of qualified personnel is an equity problem because it denies learning opportunities to students who want to know more about computers. Educators can try to supplement existing staff by analyzing the personnel actually required and investigating alternative resources.

Appraisal Determine how many teachers, aides, or supervisors are needed for computer instruction and activities.

Here are some ideas.

1. Determine how much the computers in your school are being used. You could place log-in and log-out sheets at each computer station or use an observation sheet to record how many students (or teachers) use each computer and for how long. Are there computers that are used only infrequently? Does a lack of personnel affect the use of any computers?

2. Review students' responses to survey questions #9, 10, and 11 about availability and use of computers during free time. When is the demand greatest? How much help would be required to meet these needs?

Awareness Find out what adults or students might be available to assist with computer activities.

Here are some possibilities.

1. Arrange for the computer coordinator and the principal to make a presentation at a faculty meeting about the need for more teachers, aides, and supervisors for computer activities. Have them outline the demands for computer activities and describe the effects of denying students the opportunity to use the computers. As part of the presentation, ask them to solicit help from

   - teachers who have computer skills and are willing to help
   - teachers who lack computer skills but are willing to learn
   - teachers who have other skills that can be used for computer activities (to plan computer-related science projects, to write poetry on the computer, to create math problems on the computer).

   Use responses to develop action plans.

2. Consider using other students to help with computer activities. You might use older students (high school students for a junior high program, for example, or sixth grade students for primary grades) or peers who are knowledgeable about computers. Consult with computer coordinators, other teachers, and administrators to find out which students might be qualified to supervise, tutor, network, or assist in other ways.

3. Talk with parents about the shortage of teachers and supervisors and how this affects their children's education. Use a variety of methods: newsletters, flyers, discussions during parent conferences, bulletin boards at Parents' Night, student demonstrations in the computer lab, and talks to parent groups.

4. Contact community groups like a service club, retired business persons' organization, or alumni association to see if members might be willing to act as volunteers in computer activities. Again, explain how the lack of personnel is limiting students' opportunities.

Action Obtain additional resources to provide maximum access to the computers in your school.

Here are some suggestions.

1. During free periods, have adult volunteers provide the necessary supervision while qualified student tutors and aides help other students with their problems. The adult volunteer can maintain order but does not have to be computer literate. The volunteer can also learn about computers from the tutors or a self-paced course, while providing opportunities for students simultaneously.

2. Encourage all staff members to visit the computer and watch students use the computer. The computer teacher could design an appropriate application (e.g., word processing for English, CAI for math, etc.), and students could demonstrate these applications. With increased awareness, staff members may be motivated to help expand the use of computers in your school.

3. Get reluctant teachers started with computers by engaging them in tasks not carried out at a terminal. For example, encourage them to hold values discussions with students about the moral issues involved in copying software. Have them assign student papers on the ethics of solving programming problems for another student and having the student claim the project. Encourage colleagues to include computer-related topics in their courses, such as how simulations can be used in social studies and computer technology in science. This could be done during an Open House or at other times throughout the year.

4. Provide incentives for staff members and parent volunteers to become involved in the computer program. Provide the needed training, lend them software, or arrange for them to take the computer home on weekends or vacations. Give parents some responsibility and autonomy but make the responsibilities and requirements clear. Establish a system of trades: if a parent provides 1 hour of help with students, you provide the parent with 2 hours of training. The parent thus provides qualified help and gains computer knowledge as well as the satisfaction of helping students.

5. Contact local computer firms or dealers and explain how the lack of computer training limits computer use by students. Since these firms have an interest in promoting computer education, they are often responsive to school needs. Find out if they have courses or other resources to help train teachers, volunteers, or students or if they can suggest other solutions. Publicize these courses and resources through the school newsletter and bulletin boards in the school office, teachers' lounge, and classrooms.

Assessment Review the results of your efforts to obtain additional resources for computer utilization in your school.

Here are some suggestions.

1. Conduct another survey of computer use in your school using either log-in sheets or observation. Has the use of computers increased? By how much? Are individuals available to provide assistance and supervision for computer activities as needed?

2. Ask your computer teachers, aides, or volunteers how they became involved. Were any of the strategies you used responsible for their involvement? How can you modify these strategies or continue to use them to attract additional resources in the future?

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